International Seabed Authority ISBA/21/LTC/15

Legal and Technical Commission

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Recommendations for the guidance of contractors on the content, format and structure of annual reports

1. The Legal and Technical Commission of the International Seabed Authority, acting pursuant to regulation 39 of the Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area, regulation 41 of the Regulations on Prospecting and Exploration for Polymetallic Sulphides in the Area and regulation 41 of the Regulations on Prospecting and Exploration for Cobalt-rich Ferromanganese Crusts in the Area, issues the present recommendations for the guidance of contractors.

I. Introduction

2. In the present recommendations, references to the "Regulations" are collective references to the Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area, the Regulations on Prospecting and Exploration for Polymetallic Sulphides in the Area and the Regulations on Prospecting and Exploration for Cobalt-rich Ferromanganese Crusts in the Area. References to the "clauses" are references to the standard clauses applicable to the particular contract in question.

3. The purpose of the present recommendations is to provide guidance to contractors in relation to the content, format and structure of their annual reports. It includes general requirements for their annual reports and specific guidance for reporting on the exploration under contract for polymetallic nodules, polymetallic sulphides and cobalt-rich ferromanganese crusts. The recommendations supersede the guidance provided by the Commission in the annex to document ISBA/8/LTC/2 and should be applied by all contractors with effect from 1 January 2016.

II. General requirements

4. Annual reports shall be submitted to the Secretary-General by the end of March each year on the activities carried out in the previous year and contain the information specified in section 10 of annex IV to the Regulations.

5. Reports should be submitted in hard copy and electronic format and all environmental and geological data should be submitted in a digital and spatially georeferenced format that is compatible with the Authority's requirements, using the

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templates published by the Commission and listed in annex IV to the present document.

6. Reports should present the results of the work of the reporting year with reference to the approved plan of work for exploration. The contractor should indicate its short-term (1 year), medium-term (5 years) and long-term (10-15 years) objectives. The reports should also contain information on project management to enable an overview of progress in the implementation of the programme of work and, where applicable, training programmes.

7. Reports should indicate clearly the actual work carried out during the reporting year.

III. Specific guidance

8. The recommended content, format and structure of annual reports on the exploration under contract for polymetallic nodules is provided in annex I.

9. The recommended content, format and structure of annual reports on the exploration under contract for polymetallic sulphides is provided in annex II.

10. The recommended content, format and structure of annual reports on the exploration under contract for cobalt-rich ferromanganese crusts is provided in annex III.

11. A list of the templates to be used for reporting geological and environmental data is provided in annex IV.

12. The Authority's classification standard for reporting mineral exploration results assessments, mineral resources and mineral reserves, as adopted by the Commission, is provided in annex V.

Annex I

Content, format and structure of annual reports for exploration under contract for polymetallic nodules

I. Executive summary

1. The contractor is requested to provide a summary of major achievements and challenges in 20xx [indicate year] (maximum four pages).

II. General

2. The contractor is requested to provide:

(a) Information on adjustments made to the programme of activities, if any, for 20xx [indicate year];

(b) A response to the comments of the International Seabed Authority, if any, on the previous annual report.

III. Result of exploration work

3. Intended programme and actual completion

The contractor is requested to report on the annual work programme that has been carried out and to provide information on any deviation from the intended programme.

4. Methods and equipment

The contractor is requested to list and describe the methods applied and equipment used for mapping, sampling or the conduct of any other activities for the exploration of the seabed and its subsoil during its survey cruises.

(a) Mapping

The contractor is requested to give a general description of the methods, acquisition equipment and procedures (calibration, installation details, etc.) used for surveying the exploration area. The Authority is aware that these methods include, but are not restricted to, the following:

(i) Single beam and multibeam echo sounding (hull-mounted and/or from remotely operated vehicles or autonomous underwater vehicles);

(ii) Side-scan sonar profiling (towed from the vessel, from remotely operated vehicles, autonomous underwater vehicles or other);

(iii) Subbottom profiling;

(iv) Photography and video recording done by TV grab, sledge, remotely operated vehicles, autonomous underwater vehicles, submersibles or other;

(b) Sampling

The contractor is requested to give a general description of the sampling programme that has been completed, including the sampling equipment and the procedures for the use thereof, namely corers, grabs, dredges or other methods and equipment. This description should be formulated with a view to supporting the reporting of geological and environmental data on polymetallic nodules in the appropriate templates (see annex IV);

(c) Other activities

The contractor is requested to give a general description of any other activities conducted to obtain relevant seabed or subsurface information and data.

5. Data obtained

The contractor is requested to report the data collected during mapping, sampling or the conduct of any other activities for the exploration of the seabed and its subsoil during its survey cruises.

(a) Navigation data

Full information on the navigation by geographical coordinates should be reported as part of all data sets. However, for easy reference, the contractors are asked to also provide separate electronic files with the coordinates of each of the following items:

(i) Station locations;

(ii) Multibeam, sonar and seismic track lines;

(iii) Ship track.

(b) Bathymetry

The Authority expects the contractor to deliver the collected and processed bathymetric data as digital xyz files in the American standard code for information interchange (ASCII) format or a common geographic information system (GIS) format. The processing sequence must be fully described.

(c) Side-scan sonar and seismic data

The Authority expects the contractor to deliver the collected data as digital files (SEG-Y or XTF) and/or as high-resolution images (JPG, PDF, TIFF, etc.).

(d) Photographs and videos

The Authority expects the contractor to deliver the photographs and videos as high-resolution representative images (JPG, PDF, TIFF, etc.).

(e) Nodule characteristics

The nodules are characterized by their abundance, morphology, mineral composition, chemistry and physical properties. The contractor is requested to give a general description of those characteristics and of the analytical methods applied. The specific results of the analyses of the

nodules and substrate at each sampling station should be reported in a table in the format of the template for geological data on polymetallic nodules (see annex IV).

6. Interpretations and assessments

The contractor is requested to report the results of the interpretations of the geology of the mineral deposit and the resource assessments made on the basis of the data that have been collected.

(a) Interpretations of the mineral deposit

The interpretations made by the contractor regarding the different aspects of the mineral deposit may be reported as a set of commented maps, for instance on bathymetry, seabed morphology, geology or lithology, nodule abundance, metal distribution, resource distribution, etc. (as shapefiles and digital images).

(b) Mineral resource estimates

If the contractor has reached the stage of making resource estimates of the mineral deposits, the following items should be reported on in detail:

(i) The estimation method;

(ii) The resource/reserve classification, reported in accordance with the Authority's reporting standard (see annex V).

(c) The report should also contain a statement of the quantity of nodules recovered as samples or for the purpose of testing (even if the quantity is null).

7. Future strategy for exploration work

The contractor is requested to report on any development in its future strategy for exploration work.

IV. Environmental baseline studies (monitoring and assessment)

8. For guidance on environmental baseline studies, the contractor should refer to the recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration for marine minerals in the Area (ISBA/19/LTC/8, sect. III).

A. Environmental monitoring

9. The contractor is also requested to provide:

(a) A description of the objectives during the reporting period (intended, ongoing and completed);

(b) Information on the technical equipment and methodologies used at depth, on board and in the laboratory (including analysis software);

(c) The results produced (also summarized as graphic representations of data on which the results are based);

(d) An interpretation of the findings, including comparisons with published data from other studies;

(e) Information on physical oceanography (characteristics of water column and near-bed currents, including current speed and direction, temperatures, turbidity at different water depths, as well as any hydrodynamic modelling). Data should be linked to long-term mooring-based observations;

(f) Information on chemical oceanography (characteristics of sea water, including pH value, dissolved oxygen, total alkalinity, nutrient concentrations, dissolved and particulate organic carbon, estimation of mass flux, heavy metals, trace elements and chlorophyll a);

(g) Information on biological communities and biodiversity studies (including megafauna, macrofauna, meiofauna, microflora, nodule fauna, demersal scavengers and pelagic communities);

(h) Information on ecosystem functioning (such as measures of bioturbation, stable isotopes and sediment community oxygen consumption).

B. Environmental assessment

10. The contractor is requested to provide:

(a) Information on the environmental impact of exploration activities including information on a monitoring programme before, during and after specific activities with the potential for causing serious harm;

(b) A statement that activities undertaken in the contract area in the year covered by the annual report have not caused serious harm and the evidence of how this has been determined;

(c) Information on the environmental impact of test-mining activities as measured in the impact reference zones;

(d) An assessment of statistical robustness/power, taking into account sample sizes, sample number and, for biological communities, the abundance of individual species (with evidence for statistical significance);

(e) A gap analysis and future strategy to achieve the goals of the five-year programme of activities and the requirements contained in ISBA/19/LTC/8;

(f) An examination of the recovery over time of seabed communities following disturbance experiments conducted on the sea floor;

(g) An evaluation of the advantages and disadvantages of different sampling and analysis methods, including quality control;

(h) A comparison of environmental results in similar areas to understand species ranges and dispersal on the scale of ocean basins.

11. All data used in the report (figures, graphs and pictures) should be reported using the Excel template for environmental data on polymetallic nodules (see annex IV).

V. Mining tests and proposed mining technologies

12. The contractor is requested to provide:

(a) Data and information on the nature of the mining equipment designed and tested, where applicable, as well as data on the use of equipment not designed by the contractor;

(b) A description of the equipment, the operations and the results of the mining tests;

(c) A description of the nature and results of the experiments (where applicable);

(d) With regard to mining technologies, information on the technological progress made by the contractor with its mining system (e.g. collectors, riser, production vessel or other) development programme;

(e) With regard to processing technologies:

(i) Information on the mineral processing and metallurgical testing and processing routes, for instance whether three metals, five metals, rare earth elements or other;

(ii) Information on other methods.

VI. Training programme

13. The contractor is requested to provide detailed information on the implementation of the training programme, in accordance with schedule 3 of the contract, bearing in mind the requirements contained in the recommendations for the guidance of contractors and sponsoring States to training programmes under plans of work for exploration (ISBA/19/LTC/14).

VII. International cooperation

14. The contractor is requested to provide information on:

(a) Participation in cooperative programmes sponsored by the Authority;

(b) Cooperation with other contractors;

(c) Other international cooperation.

VIII. Certified financial statement of actual and direct exploration expenditure

15. The contractor is requested to provide a detailed financial statement that complies with the recommendations for the guidance of contractors for the reporting of actual and direct exploration expenditure (ISBA/21/LTC/11), as required under annex IV, section 10, of the Regulations.

IX. Programme of activities for the following year

16. The contractor is requested:

(a) To briefly indicate the work proposed to be carried out in the following year;

(b) To describe the proposed adjustments to the original programme of activities for the following year under the contract;

(c) To explain the reasons for such adjustments.

X. Additional information provided by the contractor

17. The contractor is requested to provide:

(a) A list of relevant publications in peer-reviewed journals published during the reporting year;

(b) Complete references to all relevant documents, press releases and scientific publications cited in the report.

Annex II

Content, format and structure of annual reports for exploration under contract for polymetallic sulphides

I. Executive summary

1. The contractor is requested to provide a summary of major achievements and challenges in 20xx [indicate year] (maximum four pages).

II. General

2. The contractor is requested to provide:

(a) Information on adjustments made to the programme of activities, if any, for 20xx [indicate year];

(b) A response to the comments of the International Seabed Authority, if any, on the previous annual report.

III. Result of exploration work

3. Intended programme and actual completion

The contractor is requested to report on the annual work programme that has been carried out and to provide information on any deviation from the intended programme.

4. Methods and equipment

The contractor is requested to list and describe the methods applied and equipment used for mapping, sampling or the conduct of any other activities for the exploration of the seabed and its subsoil during its survey cruises.

(a) Mapping

The contractor is requested to give a general description of the methods, acquisition equipment and procedures (calibration, installation details, etc.) used for surveying the exploration area (seabed or near bottom waters). The Authority is aware that these methods include, but are not restricted to, the following:

(i) Single beam and multibeam echo sounding (hull-mounted and/or from remotely operated vehicles, autonomous underwater vehicles);

(ii) Measurement of the conductivity, temperature and depth (CTD), either hydro-casts or tow-yo;

(iii) Side-scan sonar profiling (towed from the vessel, from remotely operated vehicles, autonomous underwater vehicles or other);

(iv) Subbottom profiling;

(v) Electromagnetic profiling;

(vi) Photography and video recording done by TV grab, sledge, remotely operated vehicles, autonomous underwater vehicles, submersibles or other;

(vii) Other methods.

(b) Sampling

The contractor is requested to give a general description of the sampling programme that has been completed, including the sampling equipment and the procedures for the use thereof, namely corers, grabs, dredges, remotely operated vehicles, submersibles or other methods and equipment. This description should be formulated with a view to supporting the reporting of geological and environmental data on polymetallic sulphides in the appropriate templates (see annex IV).

(c) Other activities

The contractor is requested to give a general description of any other activities conducted to obtain relevant seabed or subsurface information and data.

5. Data obtained

The contractor is requested to report the data collected during mapping, sampling or the conduct of any other activities for the exploration of the seabed and its subsoil during its survey cruises.

(a) Navigation data

Full information on the navigation by geographical coordinates should be reported as part of all data sets. However, for easy reference, the contractors are asked to also provide separate electronic files with the coordinates of each of the following items:

(i) Station locations;

(ii) Multibeam, sonar and seismic track lines;

(iii) Ship track.

(b) Bathymetry

The Authority expects the contractor to deliver the collected and processed bathymetric data as digital xyz files in the American standard code for information interchange (ASCII) format or a common geographic information system (GIS) format. The processing sequence must be fully described.

(c) Side-scan sonar and seismic data

The Authority expects the contractor to deliver the collected data as digital files (SEG-Y or XTF) and/or as high-resolution images (JPG, PDF, TIFF, etc.).

(d) (Electro)Magnetic data

The Authority expects the contractor to deliver the collected (electro)magnetic data as digital grids in a common GIS format.

(e) Electric self-potential data

The Authority expects the contractor to deliver the collected self-potential data as digital grids in a common GIS format.

(f) Near-bottom water parameters

The Authority expects the contractor to deliver the collected near-bottom water data (temperature, salinity, turbidity or transparency, Eh, pH, etc.) as tables (Excel, txt, etc.) and graphs in digital format.

(g) Photographs and videos

The Authority expects the contractor to deliver the photographs and videos as high-resolution representative images (JPEG, PDF, TIFF, etc.).

(h) Polymetallic sulphide characteristics

The polymetallic sulphide deposits are characterized by their mineral composition, chemistry and physical properties. The contractor is requested to give a general description of those characteristics and of the analytical methods applied to the mineral deposit itself and associated metalliferous sediments. The specific results of the analyses of the polymetallic sulphides, low temperature mineralization and substrate at each sampling station should be reported in a table in the format of the template for geological data on polymetallic sulphides (see annex IV).

6. Interpretations and assessments

The contractor is requested to report the results of the interpretations of the geology of the mineral deposit and the resource assessments made on the basis of the data that have been collected.

(a) Interpretations of the mineral deposit

The interpretations made by the contractor regarding the different aspects of the mineral deposit may be reported as a set of commented maps, for instance on bathymetry, seabed morphology, geology (including deposit delineation), lithology, mineralogy, etc. (as shapefiles and digital images).

(b) Hydrothermal activity associated with deposits

Of special interest in the case of polymetallic sulphide deposits is information on the associated hydrothermal activity. The contractor is requested to report such information with regard to active and inactive fields as follows:

(i) Method of hydrothermal activity detection:

- Direct observation (visualization), with representative photographs
- Indirect observation (anomalies in the water column), with hydro-casts and/or tow-yo

(c) Mineral resource estimates

If the contractor has reached the stage of making resource estimates of the mineral deposits, the following items should be reported on in detail:

(i) The estimation method;

(ii) The resource/reserve classification, reported in accordance with the Authority's reporting standard (see annex V).

(d) The report should also contain a statement of the quantity of polymetallic sulphides recovered as samples or for the purpose of testing (even if the quantity is null).

7. Future strategy for exploration work

The contractor is requested to report on any development in its future strategy for exploration work.

IV. Environmental baseline studies (monitoring and assessment)

8. For guidance on environmental baseline studies, the contractor should refer to the recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration for marine minerals in the Area (ISBA/19/LTC/8, sect. III).

A. Environmental monitoring

9. The contractor is requested to provide:

(a) A description of the objectives during the reporting period (intended, ongoing and completed);

(b) Information on the technical equipment and methodologies used at depth, on board and in the laboratory (including analysis software);

(c) The results produced (also summarized as graphic representations of data on which the results are based);

(d) An interpretation of the findings, including comparisons with published data from other studies;

(e) Information on physical oceanography (characteristics of sea water and bottom currents, including current speed and direction, temperatures, turbidity at different water depths, downslope transport as well as any hydrodynamic modelling). Data should also be linked to any long-term moorings for the exploration work;

(f) Information on chemical oceanography (characteristics of sea water, including pH value, dissolved oxygen, total alkalinity, nutrient concentrations, dissolved and particulate organic carbon, estimation of mass flux, heavy metals, trace elements and chlorophyll a);

(g) Information on biological communities and biodiversity studies (including habitat diversity, megafauna, macrofauna, meiofauna, bacterial mats, demersal scavengers and pelagic communities);

(h) Information on ecosystem functioning (including food webs, stable isotopes, fatty acids and methane and hydrogen sulphide metabolism).

B. Environmental assessment

10. The contractor is requested to provide:

(a) Information on the environmental impact of exploration activities, including information on a monitoring programme before, during and after specific activities with the potential for causing serious harm;

(b) A statement that activities undertaken in the contract area in the year covered by the annual report have not caused serious harm and the evidence of how this has been determined;

(c) Information on the environmental impact of test-mining activities as measured in the impact reference zones;

(d) An assessment of statistical robustness/power, taking into account sample sizes, sample number and, for biological communities, the abundance of individual species (with evidence for statistical significance);

(e) A gap analysis and future strategy to achieve the goals of the five-year programme of activities and the requirements contained in ISBA/19/LTC/8;

(f) An examination of ecosystem change and recovery from natural and anthropogenic disturbances, including drilling activities;

(g) An evaluation of the advantages and disadvantages of different sampling and analysis methods, including quality control;

(h) A comparison of environmental results in similar areas to understand species ranges and dispersal on the scale of ocean basins.

11. All data used in the report (figures, graphs and pictures) should be reported using the Excel template for environmental data on polymetallic sulphides (see annex IV).

V. Mining tests and proposed mining technologies

12. The contractor is requested to provide:

(a) Data and information on the nature of the mining equipment designed and tested, where applicable, as well as data on the use of equipment not designed by the contractor;

(b) A description of the equipment, the operations and the results of the tests;

(c) A description of the nature and results of the experiments (where applicable);

(d) With regard to mining technologies, information on the technological progress made by the contractor with its mining system (e.g. collectors, riser, production vessel or other) development programme;

(e) With regard to processing technologies:

(i) Information on mineral processing and metallurgical testing and processing routes;

(ii) Information on other methods.

VI. Training programme

13. The contractor is requested to provide detailed information on the implementation of the training programme, in accordance with schedule 3 of the contract, bearing in mind the requirements contained in the recommendations for the guidance of contractors and sponsoring States to training programmes under plans of work for exploration (ISBA/19/LTC/14).

VII. International cooperation

14. The contractor is requested to provide information on:

(a) Its participation in cooperative programmes sponsored by the Authority;

(b) Cooperation with other contractors;

(c) Other international cooperation.

VIII. Certified financial statement of actual and direct exploration expenditure

15. The contractor is requested to provide a detailed financial statement that complies with the recommendations for the guidance of contractors for the reporting of actual and direct exploration expenditure (ISBA/21/LTC/11), as required under annex 4, section 10, of the Regulations.

IX. Programme of activities for the following year

16. The contractor is requested:

(a) To briefly indicate the work proposed to be carried out in the following year;

(b) To describe the proposed adjustments to the original programme of activities for the following year under the contract;

(c) To explain the reasons for such adjustments.

X. Additional information provided by the contractor

17. The contractor is requested to provide:

(a) A list of relevant publications in peer-reviewed journals published during the reporting year;

(b) Complete references to all relevant documents, press releases and scientific publications cited in the report.

Annex III

Content, format and structure of annual reports for exploration under contract for cobalt-rich ferromanganese crusts

I. Executive summary

1. The contractor is requested to provide a summary of major achievements and challenges in 20xx [indicate year] (maximum four pages).

II. General

2. The contractor is requested to provide:

(a) Information on adjustments made to the programme of activities, if any, for 20xx [indicate year];

(b) A response to the comments of the International Seabed Authority, if any, on the previous annual report.

III. Result of exploration work

3. Intended programme and its actual completion

The contractor is requested to report on the annual work programme that has been carried out and to provide information on any deviation from the intended programme.

4. Methods and equipment

The contractor is requested to list and describe the methods applied and equipment used for mapping, sampling or the conduct of any other activities for the exploration of the seabed and its subsoil during its survey cruises.

(a) Mapping

The contractor is requested to give a general description of the methods, acquisition equipment and procedures (calibration, installation details, etc.) used for surveying the exploration area. The Authority is aware that these methods include, but are not restricted to, the following:

(i) Single beam and multibeam echo sounding (hull-mounted and/or from remotely operated vehicles or autonomous underwater vehicles);

(ii) Side-scan sonar profiling (towed from the vessel, from remotely operated vehicles, autonomous underwater vehicles or other);

(iii) Subbottom profiling (done by hull-mounted or remotely operated vehicles and autonomous underwater vehicles);

(iv) Photography and video recording done by TV grab, sledge, remotely operated vehicles, autonomous underwater vehicles, submersibles or other;

(v) Other methods (e.g. gamma-ray detection).

(b) Sampling

The contractor is requested to give a general description of the sampling programme that has been completed, including the sampling equipment and the procedures for the use thereof, namely drill coring, dredges, remotely operated vehicles, submersibles or other methods and equipment. This description should be formulated with a view to supporting the reporting of geological and environmental data on cobalt-rich ferromanganese crusts in the appropriate templates (see annex IV).

(c) Other activities

The contractor is requested to give a general description of any other activities conducted to obtain relevant seabed or subsurface information and data.

5. Data obtained

The contractor is requested to report the data collected during mapping, sampling or the conduct of any other activities for the exploration of the seabed and its subsoil during its survey cruises.

(a) Navigation data

Full information on the navigation by geographical coordinates should be reported as part of all data sets. However, for easy reference, the contractors are asked to also provide separate electronic files with the coordinates of each of the following items:

(i) Station locations;

(ii) Multibeam, sonar and seismic track lines;

(iii) Ship track.

(b) Bathymetry

The Authority expects the contractor to deliver the collected bathymetric data as digital xyz files in the American standard code for information interchange (ASCII) format or a common geographic information system (GIS) format.

(c) Side-scan sonar and seismic data

The Authority expects the contractor to deliver the collected data as digital files (SEG-Y or XTF) and/or as high-resolution images (JPG, PDF, TIFF, etc.).

(d) Photographs and videos

The Authority expects the contractor to deliver the photographs and videos as high-resolution representative images (JPG, PDF, TIFF, etc.).

(e) Cobalt-rich ferromanganese crust characteristics

The cobalt-rich ferromanganese crust deposits are characterized by their thickness, crust coverage, mineral composition, chemistry and physical properties. The contractor is requested to give a general description of those characteristics and of the analytical methods applied. The specific results of the analyses of the cobalt-rich ferromanganese crusts at each sampling station should be reported in a table in the format of the template for geological data on cobalt-rich ferromanganese crusts (see annex IV).

6. Interpretations and assessments

The contractor is requested to report the results of the interpretations of the geology of the mineral deposit and the resource assessments made on the basis of the data that have been collected.

(a) Interpretations of the mineral deposit

The interpretations made by the contractor regarding the different aspects of the mineral deposit may be reported as a set of commented maps, for instance on bathymetry, seabed morphology, geology and lithology, crust coverage, metal distribution, crust thickness and its spatial and regional variation (including variation with depth) as shapefiles and digital images.

(b) Mineral resource estimates

If the contractor has reached the stage of making resource estimates of the mineral deposits, the following items should be reported on in detail:

(i) The estimation method;

(ii) The resource/reserve classification, reported in accordance with the Authority's reporting standard (see annex V).

(c) The report should also contain a statement of the quantity of cobalt-rich ferromanganese crusts recovered as samples or for the purpose of testing (even if the quantity is null).

7. Future strategy for exploration work

The contractor is requested to report on any development in its future strategy for exploration work.

IV. Environmental baseline studies (monitoring and assessment)

8. For guidance on environmental baseline studies, the contractor should refer to the recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration for marine minerals in the Area (ISBA/19/LTC/8, sect. III).

A. Environmental monitoring

9. The contractor is requested to provide:

(a) A description of the objectives during the reporting period (intended, ongoing and completed);

(b) Information on the technical equipment and methodologies used at depth, on board and in the laboratory (including analysis software);

(c) The results produced (also summarized as graphic representations of data on which the results are based);

(d) An interpretation of the findings, including comparisons with published data from other studies;

(e) Information on physical oceanography (characteristics of sea water and bottom currents, including current speed and direction, temperatures, turbidity at different water depths, downslope transport as well as any hydrodynamic modelling). Data should also be linked to any long-term moorings for the exploration work;

(f) Information on chemical oceanography (characteristics of sea water, including pH value, dissolved oxygen, total alkalinity, nutrient concentrations, dissolved and particulate organic carbon, estimation of mass flux, heavy metals, trace elements and chlorophyll a);

(g) Information on biological communities and biodiversity studies (including habitat diversity, megafauna, macrofauna, meiofauna, bacterial mats, demersal scavengers and pelagic communities);

(h) Information on ecosystem functioning (including food webs, stable isotopes and fatty acids).

B. Environmental assessment

10. The contractor is requested to provide:

(a) Information on the environmental impact of exploration activities, including information on a monitoring programme before, during and after specific activities with the potential for causing serious harm;

(b) A statement that activities undertaken in the contract area in the year covered by the annual report have not caused serious harm and the evidence of how this has been determined;

(c) Information on the environmental impact of test-mining activities as measured in the impact reference zones;

(d) An assessment of statistical robustness/power, taking into account sample sizes, sample number and for biological communities the abundance of individual species (with evidence for statistical significance);

(e) A gap analysis and future strategy to achieve the goals of the five-year programme of activities and the requirements contained in ISBA/19/LTC/8;

(f) An examination of ecosystem recovery from natural and anthropogenic disturbances, where appropriate;

(g) An evaluation of the advantages and disadvantages of different sampling and analysis methods, including quality control;

(h) A comparison of environmental results in similar areas to understand species ranges and dispersal on the scale of ocean basins.

11. All data used in the report (figures, graphs and pictures) should be reported using the Excel template for environmental data on cobalt-rich ferromanganese crusts (see annex IV).

V. Mining tests and proposed mining technologies

12. The contractor is requested to provide:

(a) Data and information on the nature of the mining equipment designed and tested, where applicable, as well as data on the use of equipment not designed by the contractor;

(b) A description of the equipment, the operations and, where relevant, the results of the tests;

(c) A description of the nature and results of the experiments (where applicable);

(d) With regard to mining technologies, information on the technological progress made by the contractor with its mining system (e.g. collectors, riser, production vessel or other) development programme;

(e) With regard to processing technologies:

(i) Information on mineral processing and metallurgical testing and processing routes;

(ii) Information on other methods.

VI. Training programme

13. The contractor is requested to provide detailed information on the implementation of the training programme, in accordance with schedule 3 of the contract, bearing in mind the requirements contained in the recommendations for the guidance of contractors and sponsoring States to training programmes under plans of work for exploration (ISBA/19/LTC/14).

VII. International cooperation

14. The contractor is requested to provide information on:

(a) Its participation in cooperative programmes sponsored by the Authority;

(b) Cooperation with other contractors;

(c) Other international cooperation.

VIII. Certified financial statement of actual and direct exploration expenditure

15. The contractor is requested to provide a detailed financial statement that complies with the recommendations for the guidance of contractors for the reporting

of actual and direct exploration expenditure (ISBA/21/LTC/11), as required under annex IV, section 10, of the Regulations.

IX. Programme of activities for the following year

16. The contractor is requested:

(a) To briefly indicate the work proposed to be carried out in the following year;

(b) To describe the proposed adjustments to the original programme of activities for the following year under the contract;

(c) To explain the reasons for such adjustments.

X. Additional information provided by the contractor

17. The contractor is requested to provide:

(a) A list of relevant publications in peer-reviewed journals published during the reporting year;

(b) Complete references to all relevant documents, press releases and scientific publications cited in the report.

Annex IV

List of templates for reporting tabulated geological and environmental data

1. Template for reporting geological data on polymetallic nodules and substrate
2. Template for reporting geological data on polymetallic sulphides and substrate
3. Template for reporting geological data on cobalt-rich ferromanganese crusts
4. Template for reporting environmental data on polymetallic nodules
5. Template for reporting environmental data on polymetallic sulphides
6. Template for reporting environmental data on cobalt-rich ferromanganese crusts

Annex V

Reporting standard of the International Seabed Authority for mineral exploration results assessments, mineral resources and mineral reserves

I. Introduction

1. The present document sets out the standard to be observed in all documents submitted to the International Seabed Authority that include the reporting of estimates of resources in the Area, which that are not intended for public release or for the prime purpose of informing investors or potential investors and their advisers. These estimates should be reported according to the Authority's resource classification system that is based on the three main resource categories:(a) mineral exploration results assessments; (b) mineral resources; and (c) mineral reserves (see figure below). It is based on the November 2013 edition of the international reporting template of the Committee for Mineral Reserves International Reporting Standards (CRIRSCO).[1]

2. In the present document, important terms are defined in paragraphs highlighted in bold. When appearing in the definition of other such terms, those terms are underlined. The template clauses are shown in plain font. Paragraphs in italics that are placed after the respective clauses are intended to provide assistance and guidance to readers for interpreting the application of the clauses in the reporting standard of the Authority. Enclosure 1 contains a list of generic terms, equivalents and definitions provided to avoid duplication or ambiguity.

II. Scope

3. The main principles governing the operation and application of the reporting standard are transparency and materiality:

[1] The present annex has been prepared at the request of the International Seabed Authority by a group comprising: C. Antrim, Executive Director at the Rule of Law Committee for Oceans, United States of America; H. Parker, Deputy Chair of the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) and Consulting Mining Geologist and Geostatistician at Amec Foster Wheeler, United States; and P. R. Stephenson, former Co-Chair of CRIRSCO and Director and Principal Geologist at AMC Consultants, Canada; with input from CRIRSCO members. It follows guidelines drawn up by a working group at a workshop convened by the Authority, in collaboration with the Ministry of Earth Sciences of India, on the classification of polymetallic nodule resources, held in Goa, India from 13 to 17 October 2014. The working group members were: Mr. Stephenson; Ms. Antrim; M. Nimmo, Principal Geologist at Golder Associates, Australia; D. MacDonald, Chair of the Expert Group on Resource Classification of the Economic Commission for Europe; P. Kay, Manager at Offshore Minerals, Geoscience Australia; P. Madureira, Deputy Chief of the Task Group for the Extension of the Continental Shelf, Portugal; G. Cherkashov, Deputy Director at All-Russia Research Institute for Geology and Mineral Resources of the World Ocean, Russian Federation; T. Ishiyama, Deep Ocean Resources Development, Japan; T. Abramowski, Director General at the Interoceanmetal Joint Organization, Poland; J. Parionos, Chief Geologist at Tonga Offshore Mining Limited, Tonga; and J. Paynjon, G-TEC Sea Mineral Resources NV.

(a) Transparency requires that the Authority and, particularly, its Legal and Technical Commission be provided with sufficient information, presented in a clear and unambiguous way, so as to understand the report and not to be misled;

(b) Materiality requires that the report contain all the relevant information that the Authority and, particularly, its Legal and Technical Commission may reasonably require and expect to find in the report, for the purpose of making a reasoned and balanced judgement regarding the mineral resources or mineral reserves reported on.

4. **The reporting standard specifies the required minimum standard for all documents submitted to the Authority that include the reporting of mineral exploration results assessments, mineral resources and mineral reserves. It is not intended for release to the general public or for the prime purpose of informing investors or potential investors and their advisers.**[2] Reporting entities are encouraged to provide information that is as comprehensive as possible in their reports.[3]

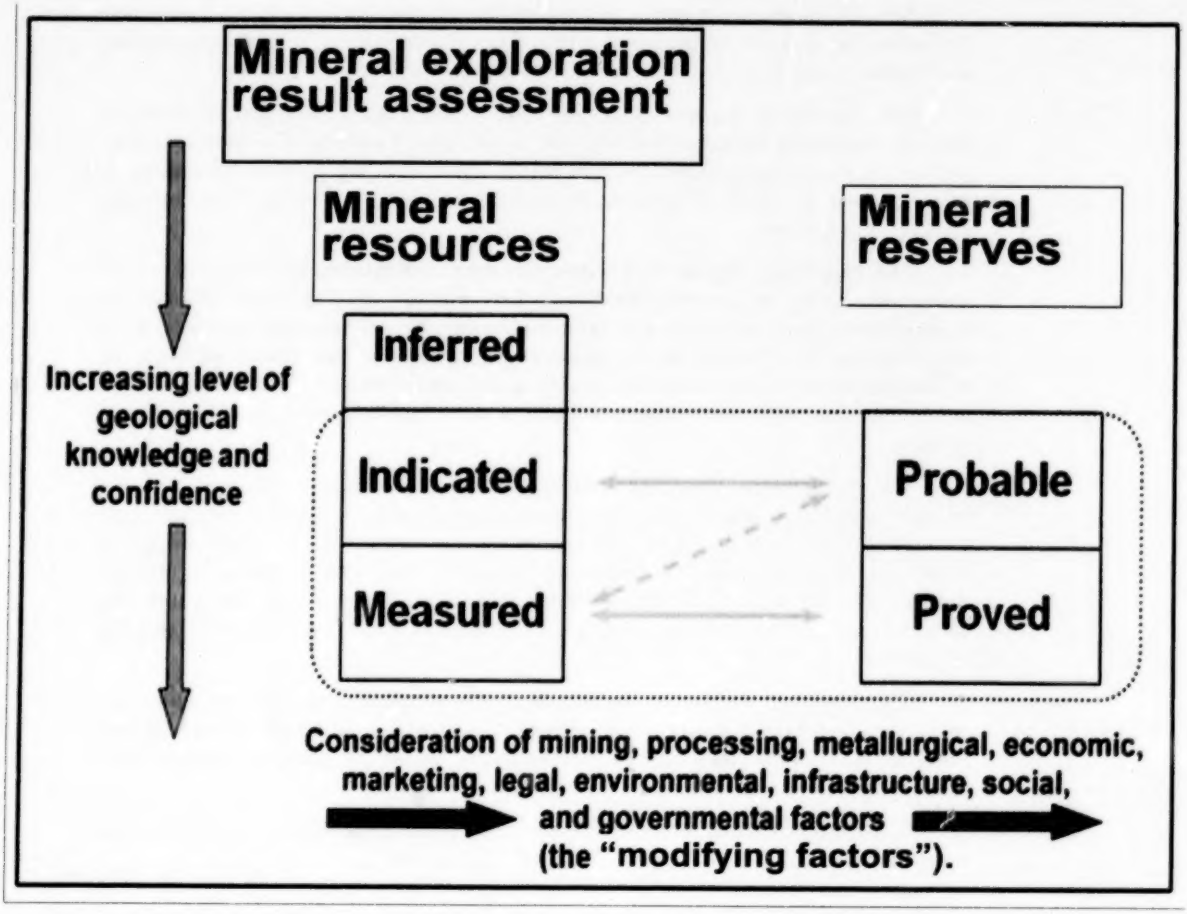
5. The estimation of mineral resources and mineral reserves is inherently subject to some level of uncertainty and inaccuracy. Considerable skill and experience may be needed to interpret pieces of information, such as geological maps and analytical results based on samples that commonly represent only a small part of a mineral deposit. The uncertainty in the estimates should be discussed in the report and reflected in the appropriate choice of mineral resource and mineral reserve categories.

6. The reporting standard is applicable to all **mineral resources** for which the reporting of **mineral exploration results assessments, mineral resources** and **mineral reserves** is required by the Authority under its rules, regulations and procedures.

7. It is recognized that a further review of the reporting standard will be required from time to time.

[2] Where reports are prepared for the prime purpose of release to the general public or for informing investors or potential investors and their advisers, the Authority recommends that they comply with one of the reporting standards that are recognized by CRIRSCO has being consistent with its international reporting template.

[3] While every effort has been made in the reporting standard of the Authority to cover most cases likely to be encountered when reporting on mineral exploration results assessments, mineral resources and mineral reserves, there may be occasions when doubt exists as to the appropriate form of disclosure. On such occasions, users of the reporting standard and those who compile reports to comply with the standard should be guided by its intent, namely, to provide a minimum standard for such reporting and to ensure that such reporting contains all the information that readers may reasonably require and expect for the purpose of making a reasoned and balanced judgement on the mineral exploration results assessments, mineral resources or mineral reserves reported on.



General relationship between mineral exploration results assessments, minerals resources and mineral reserves

III. Reporting terminology

8. **Modifying factors are considerations used to convert mineral resources into mineral reserves. These include, but are not restricted to, mining, processing, metallurgical, infrastructure, economic, marketing, legal, environmental, social and governmental factors.**

Guidance

9. *The figure in paragraph 7 illustrates the framework for classifying tonnage and grade estimates to reflect different levels of geological confidence and different degrees of technical and economic evaluation. Mineral resources can be estimated mainly on the basis of geological information with some input from other disciplines. Mineral reserves, which are a modified subset of the indicated and measured mineral resources (shown within the dashed outline in the figure), require*

consideration of the modifying factors affecting extraction and should in most instances be estimated with input from a range of disciplines.

10. *Measured mineral resources may be converted into either proved mineral reserves or probable mineral reserves. Measured mineral resources may be converted into probable mineral reserves because of uncertainties associated with some or all of the modifying factors that are taken into account in the conversion from mineral resources into mineral reserves. This relationship is shown by the broken arrow in the figure. Although the trend of the broken arrow includes a vertical component, it does not, in this instance, imply a reduction in the level of geological knowledge or confidence. In such a case, the modifying factors should be fully explained (see also para. 21 for a subdivision of mineral resources).*

IV. General reporting

11. Reports to the Authority concerning a contractor's mineral exploration results assessments, mineral resources or mineral reserves must include a description of the style and nature of mineralization.

12. A contractor must disclose any relevant information concerning a mineral deposit that could materially influence the economic value of that deposit to the contractor. A contractor must promptly report any material changes in its mineral resources or mineral reserves to the Authority.

13. Throughout the reporting standard, certain words are used in a generic sense when a more specific meaning might be attached to them by particular groups within the industry. In order to avoid duplication or ambiguity, those terms are listed in enclosure I together with other terms that may be regarded as synonymous for the purpose of the present document.[4]

V. Reporting of mineral exploration results assessments

14. **An exploration target is a statement or estimate of the exploration potential of a mineral deposit in a defined geological setting, where the statement or estimate, quoted as a range of tons and of grade or quality, relates to mineralization for which there has been insufficient exploration to estimate mineral resources.**

15. **Mineral exploration results assessments include data and information generated by mineral exploration programmes which might be of use to readers of the report but do not form part of a declaration of mineral resources or mineral reserves.**[5]

[4] The use of a particular term throughout the present document does not signify that it is preferred or necessarily the ideal term in all circumstances. The contractors would be expected to select and use the most appropriate terminology for the commodity or activity reported on.

[5] It should be made clear in reports that contain mineral exploration results assessments that it is inappropriate to use such information to derive estimates of tonnage and grade. It is recommended that such reports carry a continuing statement along the following lines: "The information provided in the present report/statement/release constitutes mineral exploration results assessments as defined in the reporting standard of the International Seabed Authority, in relation to clause 24. It is inappropriate to use such information for deriving estimates of tonnage and grade".

16. This sort of data is common in the early stages of exploration when the quantity of data available is generally not sufficient to allow for any estimates other than in the form of an exploration target to be reached.

17. If a contractor reports mineral exploration results assessments in relation to mineralization not classified as a mineral resource or mineral reserve, then estimates of tonnage and associated average grade must not be reported other than in the form of an exploration target.[6]

18. Reports on mineral exploration results assessments relating to mineralization not classified as a mineral resource or mineral reserve must contain sufficient information to allow a considered and balanced judgement of the significance of the results. Reports on mineral exploration results assessments must not be presented so as to unreasonably imply that mineralization of potential economic interest has been discovered.

VI. Reporting of mineral resources

19. **A mineral resource is a concentration or occurrence of solid material of economic interest in or on the Earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction.**[7]

20. **The location, quantity, grade or quality, continuity and other geological characteristics of a mineral resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling.**

21. Mineral resources are subdivided, in order of increasing geological confidence into "inferred", "indicated" and "measured" categories.

22. Portions of a mineral deposit that do not offer reasonable prospects for eventual economic extraction must not be included into a mineral resource.[8]

23. **An inferred mineral resource is that part of a mineral resource for which quantity and grade or quality are estimated on the basis of limited geological evidence and sampling. Geological evidence is sufficient to imply, but not verify, geological and grade or quality continuity.**

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[6] Descriptions of exploration targets or exploration potential given in reports should be expressed so as not to misrepresent them as an estimate of mineral resources or mineral reserves.

[7] The term "mineral resource" covers mineralization which has been identified and estimated through exploration and sampling and within which mineral reserves may be defined by the consideration and application of Modifying Factors.

[8] The term "reasonable prospects for eventual economic extraction" implies a judgement (albeit preliminary) by the contractor with respect to the technical and economic factors likely to influence the prospect of economic extraction, including the approximate mining parameters. In other words, a mineral resource is not an inventory of all mineralization drilled or sampled, regardless of cut-off parameters, likely mining dimensions, location or continuity. It is a realistic inventory of mineralization which, under assumed and justifiable technical and economic conditions, might, in whole or in part, become economically extractable. Any material assumptions made in determining the reasonable prospects for eventual economic extraction should be clearly stated in the report. Any adjustment made to the data for the purpose of making the mineral resource estimate, for example by cut-off or factoring grades, or the factoring of seabed nodule abundance measurements, should be clearly stated and described in the report.

24. **An inferred mineral resource has a lower level of confidence than that applying to an indicated mineral resource and must not be converted into a mineral reserve. It is reasonably expected that, with continued exploration, the majority of inferred mineral resources could be upgraded to indicated mineral resources.**[9]

25. The inferred category is intended to cover cases in which a mineral concentration or occurrence has been identified and limited measurements and sampling have been completed, but in which data are insufficient to allow the geological or grade continuity to be confidently interpreted. Commonly, it would be reasonable to expect that the majority of inferred mineral resources could be upgraded to indicated mineral resources with continued exploration. However, owing to the uncertainty of inferred mineral resources, it should not be assumed that such upgrading will always occur.

26. **An indicated mineral resource is that part of a mineral resource for which quantity, grade or quality, densities, shape and physical characteristics are estimated at a level of confidence high enough to allow for the application of modifying factors in sufficient detail to support mine planning and the evaluation of the economic viability of the deposit.**

27. **Geological evidence is derived from adequately detailed and reliable exploration, sampling and testing and is sufficient to assume geological and grade or quality continuity between points of observation.**

28. **An indicated mineral resource has a lower level of confidence than that applying to a measured mineral resource and may only be converted into a probable mineral reserve.**[10]

29. **A measured mineral resource is that part of a mineral resource for which quantity, grade or quality, densities, shape, and physical characteristics are estimated at a level of confidence high enough to allow for the application of modifying factors to support detailed mine planning and a final evaluation of the economic viability of the deposit.**

30. **Geological evidence is derived from detailed and reliable exploration, sampling and testing and is sufficient to confirm geological and grade or quality continuity between points of observation.**

31. **A measured mineral resource has a higher level of confidence than that applying to either an indicated mineral resource or an inferred mineral resource. It may be converted into a proved mineral reserve or to a probable mineral reserve.**

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[9] Confidence in the estimate is usually not sufficient to allow for the results of the application of technical and economic parameters to be used for detailed planning. For this reason, there is no direct link from an inferred resource to any category of mineral reserves (see the figure in para. 7). Caution should be exercised if that category is considered in technical and economic studies.

[10] Mineralization may be classified as an indicated mineral resource when the nature, quality, amount and distribution of data are sufficient to allow for a confident interpretation of the geological framework and to assume continuity of mineralization. Confidence in the estimate is sufficient to allow for the application of technical and economic parameters and to enable an evaluation of economic viability.

Guidance

32. *Mineralization may be classified as a measured mineral resource when the nature, quality, amount and distribution of data are such as to leave no reasonable doubt, in the opinion of the contractor determining the mineral resource, that the tonnage and grade of the mineralization can be estimated to within close limits, and that any variation from the estimate would be unlikely to affect significantly potential economic viability.*

33. *This category requires a high level of confidence in, and understanding of, the geology and the controls of the mineral deposit.*

34. *Confidence in the estimate is sufficient to allow for the application of technical and economic parameters and to enable an evaluation of economic viability with a high level of confidence.*

35. **The choice of the appropriate category of mineral resource depends upon the quantity, distribution and quality of data available and the level of confidence attached to those data.**

Guidance

36. *Mineral resource classification is a matter for skilled judgement and the contractor should take into account those items in enclosure 1 that relate to confidence in mineral resource estimations.*

37. *In deciding between indicated mineral resources and measured mineral resources, it may be useful to consider, in addition to the explanations relating to geological and grade continuity in paragraphs 26 and 29, the language in the guideline attached to the definition of measured mineral resources, namely that "any variation from the estimate would be unlikely to affect significantly potential economic viability".*

38. *In deciding between inferred mineral resources and indicated mineral resources, it may be useful to consider, in addition to the explanations in paragraphs 23 and 26 relating to geological and grade continuity, the guideline attached to the definition of indicated mineral resources, namely that "confidence in the estimate is sufficient to allow for the application of technical and economic parameters and to enable an evaluation of economic viability", which contrasts with the guideline relating to the definition of inferred mineral resources, namely that "confidence in the estimate of inferred mineral resources is usually not sufficient to allow for the results of the application of technical and economic parameters to be used for detailed planning" and that "caution should be exercised if that category is considered in technical and economic studies".*

39. *The contractor should take into consideration the style of mineralization, scale and cut-off parameters when assessing geological and grade continuity.*

40. Mineral resource estimates are not precise calculations, being dependent on the interpretation of limited information on the location, shape and continuity of the occurrence and on the available sampling results. The reporting of tonnage and grade figures should reflect the relative uncertainty of the estimate by rounding off

to significant figures and, in the case of inferred mineral resources, by using terms such as "approximately".[11]

Guidance

41. *The contractor is encouraged, where appropriate, to discuss the relative accuracy or confidence level of the mineral resource estimates. The statement should specify whether it relates to estimates that are global (whole resource) or local (a subset of the resource for which the accuracy /or confidence level might differ from that of the whole resource), and, if local, state the relevant tonnage or volume. Where a statement of the relative accuracy or confidence level is not possible, a qualitative discussion of the uncertainties should be provided (see enclosure 1).*

42. Reports of mineral resources must specify one or more of the "inferred", "indicated" and "measured" categories. Categories must not be reported in a combined form unless details of the individual categories are also provided. Mineral resources must not be reported in terms of contained metal or mineral content unless corresponding tonnages and grades are also presented. Mineral resources must not be aggregated with mineral reserves.[12]

43. Enclosure 1 provides, in a summary form, a list of the main criteria that should be considered when preparing reports on mineral exploration results assessments, mineral resources and mineral reserves. These criteria need not be discussed in a report unless they materially affect the estimation or the classification of the mineral resources.[13]

44. The words "ore" and "reserves" must not be used in providing mineral resource estimates, as those terms imply technical feasibility and economic viability and are only appropriate when all relevant modifying factors have been considered. Reports and statements should continue to refer to the appropriate category or categories of mineral resources until technical feasibility and economic viability have been established. If a re-evaluation indicates that any part of the mineral

[11] In most cases, rounding off to the second significant figure should be sufficient. For example, 10,863,000 tons at 8.23 per cent should be stated as 11 million tons at 8.2 per cent. There will be occasions, however, where rounding off to the first significant figure may be necessary in order to convey properly the uncertainties in estimation. This would usually be the case with inferred mineral resources. To emphasize the imprecise nature of a mineral resource estimate, the final result should always be referred to as an estimate and not a calculation.

[12] Reporting tonnage and grade outside the categories covered by the reporting standard is not permitted.

[13] It is not necessary, when reporting, to comment on each item in enclosure 1, but it is essential to discuss any matters that might materially affect the reader's understanding or interpretation of the results assessments or estimates reported on. This is particularly important where inadequate or uncertain data affect the reliability of, or confidence in, a statement of exploration results assessments or an estimate of mineral resources or mineral reserves, for example, poor sample recovery, reliance on video or acoustic seabed reconnaissance results, etc. If there is doubt as to what should be reported, it is better to provide too much information rather than too little. Uncertainties in any of the criteria listed in enclosure 1 that could lead to under- or over-statement of resources should be disclosed.

reserves is no longer viable, such mineral reserves must be reclassified as mineral resources or removed from the mineral resource and mineral reserve statements.[14]

VII. Reporting of mineral reserves

45. **A mineral reserve is the economically mineable part of a measured or indicated mineral resource.**

46. **It includes diluting materials and allowances for losses, which may occur when the material is mined or extracted, and is defined by studies at pre-feasibility or feasibility level, as appropriate, that include the application of modifying factors. Such studies demonstrate that, at the time of reporting, extraction could reasonably be justified.**

47. **The reference point at which reserves are defined, usually the point where the ore is delivered to the processing plant, must be stated. It is important that, wherever the reference point is different, a clarifying statement be included to ensure that the reader is fully informed of what is being reported.**

Guidance

48. *Mineral reserves are those portions of mineral resources that, after the application of all mining factors, result in an estimated tonnage and grade which, in the opinion of the contractor making the estimates, can be the basis of a viable project, after taking account of all relevant modifying factors.*

49. *When reporting mineral reserves, information on estimated mineral processing recovery factors is very important, and should always be included in reports.*

50. *The term "economically mineable" implies that the extraction of the mineral reserve has been demonstrated to be viable under reasonable financial assumptions. What may be "realistically assumed" will vary with the type of deposit, the level of study that has been carried out and the financial criteria of the individual contractor. For this reason, there can be no fixed definition for the term "economically mineable". However, it is expected that companies will attempt to achieve an acceptable return on the capital invested, and that returns to investors in the project will be competitive with alternative investments of comparable risk.*

51. *In order to achieve the required level of confidence in the mineral resources and all the modifying factors, studies of pre-feasibility or feasibility, as appropriate, will have been carried out before determining the mineral reserves. The study will need to determine a mine plan that is technically achievable and economically viable and from which the mineral reserves can be derived.*

52. *The term "mineral reserves" need not necessarily signify that extraction facilities are in place or operative, or that all necessary approvals or sales contracts have been received. It signifies that there are reasonable expectations of*

[14] It is not intended that the reclassification from mineral reserves to mineral resources, or vice versa, should be applied as a result of changes expected to be of a short-term or temporary nature, or where a contractor's management has made a deliberate decision to operate on a non-economic basis. Examples of such cases include commodity price fluctuations expected to be of short duration, mine emergency of a non-permanent nature and transport strike.

such approvals or contracts. The contractor should consider the materiality of any unresolved matter that is dependent on a third party on which extraction is contingent.

53. *Any adjustment made to the data for the purpose of making the mineral reserve estimate, for example by cut-off or factoring grades, or the factoring of seabed nodule abundance measurements, should be clearly stated and described in the report.*

54. *It should be noted that the reporting standard does not imply that an economic operation should have proved mineral reserves. Cases may arise where probable mineral reserves alone may be sufficient to justify extraction. This is a matter of judgement by the contractor.*

55. **A probable mineral reserve is the economically mineable part of an indicated and, in some circumstances, measured mineral resource. The level of confidence in the modifying factors applying to a probable mineral reserve is lower than that applying to a proved mineral reserve.**

56. A probable mineral reserve has a lower level of confidence than a proved mineral reserve but is sufficiently reliable to serve as the basis for a decision on the development of the deposit.

57. **A proved mineral reserve is the economically mineable part of a measured mineral resource and implies a high degree of confidence in the modifying factors.**

58. A proved mineral reserve represents the highest level of confidence for reserve estimates.[15]

59. The choice of the appropriate category of the mineral reserve is determined primarily by the relevant level of confidence in the mineral resource and after considering any uncertainties in the modifying factors. The allocation of the appropriate category must be made by the contractor.

60. The reporting standard provides for a direct relationship between indicated mineral resources and probable mineral reserves, and between measured mineral resources and proved mineral reserves. In other words, the level of geological confidence for probable mineral reserves is similar to that required for the determination of indicated mineral resources. The level of geological confidence for proved mineral reserves is similar to that required for the determination of measured mineral resources. Inferred mineral resources are always in addition to mineral reserves.

Guidance

61. *The reporting standard also provides for a two-way relationship between measured mineral resources and probable mineral reserves. This provision is to cover cases in which uncertainties associated with any of the modifying factors*

[15] The style of mineralization or other factors could mean that the status of proved mineral reserves is not achievable in some deposits. The contractor should be aware of the consequences of declaring material of the highest confidence category before satisfying themselves that all of the relevant resource parameters and modifying factors have been established at a similarly high level of confidence.

considered when converting mineral resources into mineral reserves may result in there being a lower degree of confidence in the mineral reserves than in the corresponding mineral resources. Such a conversion would not imply a reduction in the level of geological knowledge or confidence.

62. *A probable mineral reserve derived from a measured mineral resource may be converted into a proved mineral reserve if the uncertainties in the modifying factors are removed. No amount of confidence in the modifying factors for the conversion of a mineral resource into a mineral reserve can override the upper level of confidence that exists in the mineral resource. Under no circumstances can an indicated mineral resource be converted directly into a proved mineral reserve (see the figure in para. 7).*

63. *The application of the category of proved mineral reserves implies the highest degree of confidence in the estimate, with consequent expectations in the minds of the readers of the report. Such expectations should be borne in mind when categorizing a mineral resource as measured.*[16]

64. Mineral reserve estimates are not precise calculations. The reporting of tonnage and grade figures should reflect the relative uncertainty of the estimate by rounding off to significant figures (see also para. 40).[17]

Guidance

65. *The contractors are encouraged, where appropriate, to discuss the relative accuracy or confidence level of the mineral reserve estimates. The statement should specify whether it relates to estimates that are global (whole reserve) or local (a subset of the reserve for which the accuracy or confidence level might differ from that of the whole reserve), and, if local, state the relevant tonnage or volume. Where a statement of the relative accuracy or confidence level is not possible, a qualitative discussion of the uncertainties should be provided (see enclosure 1 and the guidelines in para. 40).*

66. Reports of mineral reserves must specify one or both of the categories of "proved" and "probable". Categories must not be reported in a combined proved and probable mineral reserve unless the relevant figures are provided for each category. Reports must not present metal or mineral content figures unless corresponding tonnage and grade figures are also given. Mineral reserves must not be aggregated with mineral resources.[13]

Guidance

67. *Mineral reserves may incorporate material (dilution) that is not part of the original mineral resource. It is essential that this fundamental difference between mineral resources and mineral reserves be borne in mind and caution exercised if attempting to draw conclusions from a comparison of the two.*

68. *When revised mineral reserve and mineral resource statements are reported, they should be accompanied by a reconciliation with previous statements. A detailed*

[16] See also the guidelines in paras. 32-34 regarding the classification of mineral resources.

[17] To emphasize the imprecise nature of a mineral reserve, the final result should always be referred to as an estimate and not a calculation.

account of differences between figures is not essential, but sufficient comments should be provided to enable significant changes to be understood by the reader.

69. When figures for both the mineral resources and the mineral reserves are reported, a statement must be included in the report that clearly indicates whether the mineral resources include the mineral reserves or are reported in addition to them.

70. Mineral reserve estimates must not be included in mineral resource estimates under a single combined figure.[18]

Guidance

71. *The measured and indicated mineral resources are additional to the mineral reserves. In the former case, if any measured and indicated mineral resources have not been modified to produce mineral reserves for economic or other reasons, the relevant details of these unmodified mineral resources should be included in the report. This is to assist the reader of the report in making a judgement on the likelihood of the unmodified measured and indicated mineral resources eventually of being converted into mineral reserves.*

72. *Inferred mineral resources are by definition always in addition to mineral reserves. For reasons stated in paragraph 24 and in the present paragraph, the reported mineral reserve figures must not be included in the reported mineral resource figures. The resulting total is misleading and may be misunderstood or misused to give a false impression of a contractor's prospects.*

VIII. Technical studies

73. **A scoping study is an economic study of the potential viability of mineral resources that includes appropriate assessments of realistically assumed modifying factors, together with any other relevant operational factors that are necessary to demonstrate at the time of reporting that progress to a pre-feasibility study can be reasonably justified.**

74. **A pre-feasibility study is a comprehensive study of a range of options for the technical and economic viability of a mineral project that has advanced to a stage where a preferred mining method is established and an effective method of mineral processing is determined. It includes a financial analysis based on reasonable assumptions with regard to the modifying factors and the evaluation of any other relevant factors that are sufficient for an contractor, acting reasonably, to determine whether all or part of the mineral resource may be converted into a mineral reserve at the time of reporting. A pre-feasibility study is at a lower confidence level than a feasibility study.**

75. **A feasibility study is a comprehensive technical and economic study of the selected development option for a mineral project that includes appropriately detailed assessments of applicable modifying factors, together with any other**

[18] In some cases, there are reasons for reporting mineral resources inclusive of mineral reserves and, in other cases, for reporting mineral resources in addition to mineral reserves. It must be made clear which form of reporting has been adopted. Appropriate forms of clarifying statements may be reported.

relevant operational factors and detailed financial analysis that are necessary to demonstrate at the time of reporting that extraction is reasonably justified (economically mineable). The results of the study may reasonably serve as the basis for a final decision by a proponent or financial institution to proceed with, or finance, the development of the project. The confidence level of the study will be higher than that of a pre-feasibility study.

Guidance

76. *Enclosure 1 provides, in a summary form, a list of the criteria that should be considered when preparing reports on mineral exploration results assessments, mineral resources and mineral reserves. Those criteria need not be discussed in a report unless they materially affect the estimation or the classification of the mineral reserves. Changes in economic or political factors alone may be the basis for significant changes in mineral reserves and should be reported accordingly.*

Enclosure 1

Checklist of assessment and reporting criteria

1. The present table is a checklist that those preparing reports on mineral exploration results assessments, mineral resources and mineral reserves should use as a reference. The checklist is not prescriptive and, as always, relevance and materiality are overriding principles that determine what information should be reported. It is, however, important to report any matters that might materially affect a reader's understanding or interpretation of the results assessments or estimates that are reported. This is particularly important where inadequate or uncertain data affect the reliability of, or confidence in, a statement of mineral exploration results assessments or an estimate of mineral resources or mineral reserves.

2. The order and grouping of the criteria in the table reflect the normal systematic approach to exploration and evaluation. Criteria in the first group (sampling techniques and data) apply to all succeeding groups. In the remainder of the checklist, criteria listed in one group would often apply to succeeding groups and should be considered when estimating and reporting.

Criteria	*Explanation*
	Sampling techniques and data (criteria in this group apply to all succeeding groups)
Sampling techniques	Nature and quality of the sampling (e.g. free-fall grab samplers, box corers, box grab samplers, etc.) and measures taken to ensure sample representativity.
Sample recovery	• Indication of whether the recovery of samples has been properly recorded and the results assessed • Measures taken to maximize sample recovery and ensure the representative nature of the samples • Indication of whether a relationship exists between sample recovery and grade and whether sample bias may have occurred owing to the preferential loss or gain of fine and coarse material
Logging and sample description	• Indication of whether the samples have been logged or described to a level of detail sufficient to support appropriate mineral resource estimations, mining studies and metallurgical studies • Indication of whether logging is qualitative or quantitative in nature and provision of sample photographs
Subsampling techniques and sample preparation	• Nature, quality and appropriateness of the sample preparation technique • Quality control procedures adopted for all subsampling stages to maximize the representativity of samples • Measures taken to ensure that the sampling is representative of the material collected in situ

Criteria	*Explanation*
	• Indication of whether sample sizes are appropriate for the grain size of the material being sampled
	• Statement as to the security measures taken to ensure sample integrity is recommended
Quality of assay data and laboratory tests	• Nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total
	• Nature of the quality control procedures adopted (e.g. standards, blanks, duplicates or external laboratory checks) and whether acceptable levels of accuracy (i.e. lack of bias) and precision have been established
Location of data points	• Accuracy and quality of surveys used to locate other sample sites used in the mineral resource estimation
	• Quality and adequacy of the topographic control (providing locality plans)
Data spacing and distribution	• Data spacing for reporting mineral exploration results assessments
	• Indication of whether the data spacing and distribution are sufficient to establish the degree of geological and grade continuity appropriate for the mineral resource and mineral reserve estimation procedures and the classifications applied
	• Indication of whether sample compositing has been applied
Reporting archives	Documentation of primary data, data entry procedures, data verification, data storage (physical and electronic) for preparing the report
Audits or reviews	Results of any audits or reviews of the sampling techniques and data
	Reporting of mineral exploration results assessments (criteria listed in the preceding group also apply to this group)
Mineral rights and land ownership	• Type, reference name or number, location and ownership, including agreements or material issues with third parties, such as joint ventures, partnerships, overriding royalties, environmental setting, etc.
	• Security of the tenure held at the time of reporting, along with any known impediments to obtaining a contract to operate in the area
	• Location plans of the mineral rights and titles. It is not expected that the description of a mineral title in a technical report should represent a legal opinion but it should be a brief and clear description of such title as understood by the author
Exploration done by other parties	Acknowledgment and appraisal of exploration by other parties
Geology	• Type of deposit, geological setting and style of mineralization
	• Reliable geological maps should exist to support interpretations

Criteria	*Explanation*
Data reporting methods	• When reporting mineral exploration results assessments, maximum and minimum grade truncations (e.g. the cut-off of high grades) and cut-off grades are usually material and should be stated
	• The assumptions used for any reporting of metal equivalent values should be clearly stated
Diagrams	Where possible, maps and scaled tabulations of sample results should be included for any material discovery being reported, if such diagrams significantly clarify the report
Balanced reporting	Where the comprehensive reporting of all mineral exploration results assessments is not practicable, the representative reporting of both low and high grades and widths should be applied to avoid the misleading reporting of such assessments
Other substantive exploration data	Other exploration data, if meaningful and material, should be reported, including (but not limited to): geological observations; geophysical survey results; geochemical survey results; seabed photography or sonar results; bulk samples and the size and method of treatment; metallurgical test results; bulk density and the geotechnical and rock characteristics; potential deleterious or contaminating substances
Further work	Nature and scale of planned further work (e.g. tests for lateral extensions)
Estimation and reporting of mineral resources (criteria listed in the first group and, where relevant, in the second group, also apply to this group)	
Database integrity	• Measures taken to ensure that the data have not been corrupted by, for example, transcription or keying errors, between its initial collection and its use for mineral resource estimation purposes
	• Data verification or validation procedures used
Geological interpretation	• Confidence in (or, conversely, the uncertainty of) the geological interpretation of the mineral deposit
	• Nature of the data used and of any assumptions made
	• Effect, if any, of alternative interpretations on the mineral resource estimation
	• Use of geology in guiding and controlling the mineral resource estimation
	• Factors affecting the continuity of both grade and geology
Dimensions	Extent and variability of the mineral resource expressed as length (along strike or otherwise) and width
Estimation and modelling techniques	• Nature and appropriateness of the estimation techniques applied and key assumptions, including the treatment of extreme grade values, domaining, interpolation parameters and the maximum distance of extrapolation from data points
	• Availability of check estimates, previous estimates and mine production records, and indication of whether the mineral resource estimate takes appropriate account of such data

Criteria	*Explanation*
	• Assumptions made regarding the recovery of by-products
	• Estimation of deleterious elements or other non-grade variables of economic significance
	• In the case of a block model interpolation, block size in relation to the average sample spacing and the search employed
	• Any assumptions behind modelling of selective mining units (e.g. non-linear kriging)
	• Indicate any assumptions about correlation among variables
	• Process of validation, checking process used, comparison of model data to sampling data and use of reconciliation data, if available
	• Detailed description of the method used and the assumptions made to estimate the tonnage (or abundance) and grades (section, polygon, inverse distance, geostatistical or other method)
	• Description of how the geological interpretation was used to control the resource estimates
	• Discussion of the basis for using or not using grade cutting or capping. If a computer method was chosen, description of the programmes and parameters used
	• Geostatistical methods are extremely varied and should be described in detail. The method chosen should be justified. The geostatistical parameters, including the variogram, and their compatibility with the geological interpretation should be discussed
	• Experience gained in applying geostatistics to similar deposits should be taken into account
Moisture	Indication of whether the tonnage or abundance is estimated on a dry basis or with natural moisture, and the method of determination of the moisture content
Cut-off parameter	Basis of the adopted cut-off grade or grades, or quality or quantity parameters applied, including the basis, if appropriate, of equivalent metal formulae
Mining factors or assumptions	• Assumptions made regarding possible mining methods, minimum mining dimensions and internal (or, if applicable, external) mining dilution. It may not always be possible to make assumptions regarding mining methods and parameters when estimating mineral resources. Where no assumptions have been made, this should be reported
	• In order to demonstrate realistic prospects for eventual economic extraction, basic assumptions are necessary. Examples include geotechnical parameters, seabed topography, size of seabed mining area, infrastructure requirements and estimated mining costs. All assumptions should be clearly stated
Metallurgical factors or assumptions	• Metallurgical process proposed and appropriateness of that process to the type of mineralization. It may not always be possible to make assumptions regarding metallurgical treatment processes and parameters when reporting mineral resources. Where no assumptions have been made, this should be reported

Criteria	*Explanation*
	• In order to demonstrate realistic prospects for eventual economic extraction, basic assumptions are necessary. Examples include the extent of metallurgical test work, recovery factors, allowances for by-product credits or deleterious elements, infrastructure requirements and estimated processing costs. All assumptions should be clearly stated
Bulk density	• Indication of whether the bulk density is assumed or determined. If assumed, basis for the assumptions. If determined, method used, whether wet or dry, frequency of the measurements and nature, size and representativeness of the samples
Classification	• Basis for the classification of the mineral resources into varying confidence categories
	• Indication of whether appropriate account has been taken of all relevant factors (i.e. the relative confidence in tonnage or grade computations, the confidence in the continuity of geology and metal values, quality, quantity and the distribution of the data)
	• Indication of whether the result appropriately reflects the view that the contractor has of the deposit
Audits or reviews	Results of any audits or reviews of the mineral resource estimates
Discussion of relative accuracy and confidence	• Where appropriate, statement of the relative accuracy or confidence level of the mineral resource estimate using an approach or procedure deemed appropriate by the contractor. For example, application of statistical or geostatistical procedures to quantify the relative accuracy of the resource within stated confidence limits or, if such an approach is not deemed appropriate, qualitative discussion of the factors that could affect the relative accuracy and confidence level of the estimate
	• The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnage or abundance, which should be relevant to the technical and economic evaluation
	• The documentation should include the assumptions made and the procedures used
	• The statements of relative accuracy and confidence level of the estimate should be compared with production data, where available
Estimation and reporting of mineral reserves (criteria listed in the first group and, where relevant, in other preceding groups, also apply to this group)	
Mineral resource estimate for conversion into mineral reserves	• Description of the mineral resource estimate used as a basis for the conversion into a mineral reserve
	• Clear statement as to whether the mineral resources are reported in addition to the mineral reserves or include them
Study status	• Type and level of the study undertaken to enable the conversion of the mineral resources into mineral reserves

Criteria	*Explanation*
	• The reporting standard does not require for a final feasibility study to have been undertaken to convert mineral resources into mineral reserves; however, it requires that studies to at least pre-feasibility level have determined a mine plan that is technically achievable and economically viable, and that all modifying factors have been considered
Cut-off parameter	Basis of the cut-off grade or grades or quality parameters applied, including the basis, if appropriate, of equivalent metal formulae. The cut-off parameter may be an economic value per block rather than a grade
Mining factors or assumptions	• Method and assumptions used to convert the mineral resource into a mineral reserve (i.e. either by the application of appropriate factors by optimization or by a preliminary or detailed design)
	• Choice, nature and appropriateness of the selected mining method or methods, size of the selected mining unit and other mining parameters, including associated design issues
	• Assumptions made regarding geotechnical parameters (e.g. the seabed floor slope and the topographic conditions)
	• Mining dilution factors, mining recovery factors and minimum mining widths used
	• Infrastructure requirements of the selected mining methods and, where available, historical reliability of the performance parameters
Metallurgical factors or assumptions	• Metallurgical process proposed and appropriateness of that process to the style of mineralization
	• Indication of whether the metallurgical process is a well-tested technology or novel in nature
	• Nature, amount and representativeness of the metallurgical test work undertaken and the metallurgical recovery factors applied
	• Any assumptions or allowances made for deleterious elements
	• Existence of any bulk sample or pilot-scale test work and degree to which such samples are representative of the orebody as a whole
	• The tonnage and grades reported for mineral reserves should state clearly whether they are in respect of material sent to the plant or after recovery
	• Comment on the existing plant and equipment, including an indication of their replacement and salvage value
Cost and revenue factors	• Derivation of, or assumptions made, regarding the projected capital and the operating costs
	• Assumptions made regarding revenue, including head grade, metal or commodity prices, exchange rates, transportation and treatment charges, penalties, etc.
	• Allowances made for royalties payable, international benefit sharing, etc.

Criteria	*Explanation*
	• Basic cash flow inputs for a stated period
Market assessment	• Demand, supply and stock situation for the particular commodity, as well as consumption trends and factors likely to affect supply and demand in future
	• Customer and competitor analysis, along with the identification of likely market windows for the product
	• Price and volume forecasts and the basis for such forecasts
Other	• Effect, if any, of natural risk, infrastructure, environmental, legal, marketing, social or governmental factors on the likely viability of a project and on the estimation and the classification of the mineral reserves
	• Status of titles and approvals critical to the viability of the project, such as mining leases, discharge permits and governmental and statutory approvals
	• Environmental descriptions of anticipated liabilities
	• Location plans of mineral rights and titles
Classification	• Basis for the classification of the mineral reserves into varying confidence categories
	• Indication of whether the result appropriately reflects the view that the contractor has of the deposit
	• Proportion of probable mineral reserves that have been derived from measured mineral resources, if any
Audits or reviews	Results of any audits or reviews of the mineral reserve estimates
Discussion of relative accuracy and confidence	• Where appropriate, statement of the relative accuracy or confidence level of the mineral reserve estimate using an approach or procedure deemed appropriate by the contractor. For example, application of statistical or geostatistical procedures to quantify the relative accuracy of the reserve within stated confidence limits or, if such an approach is not deemed appropriate, qualitative discussion of the factors that could affect the relative accuracy and confidence level of the estimate
	• The statement should specify whether it relates to global or local estimates and, if local, state the relevant tonnage or abundance, which should be relevant to the technical and economic evaluation. The documentation should include the assumptions made and the procedures used
	• Statements of the relative accuracy or confidence level of the estimate should be compared with production data, where available

Enclosure 2

Generic terms and equivalents and definitions

The reporting standard of the International Seabed Authority uses in a generic sense certain words that might have a more specific meaning attached to them by particular groups in the industry. In order to avoid duplication or ambiguity, those terms are defined below, together with other terms that may be regarded as synonymous for the purposes of the present guidance.

Generic term	*Synonym or similar term*	*Definition*
Cut-off grade	Product specification	The lowest grade, or quality, of mineralized material that qualifies as economically mineable and available in a given deposit. It may be defined on the basis of economic evaluation or on the physical or chemical attributes that define an acceptable product specification
Feasibility study	–	A comprehensive study of a mineral deposit in which all geological, engineering, legal, operating, economic, social, environmental and other relevant factors are considered in such detail that it may reasonably serve as the basis for a final decision by a financial institution to finance the development of the deposit for mineral production
Grade	Quality; assay; analysis; value	Any physical or chemical measurement of the characteristics of the material of interest in samples or product
Metallurgy	Processing; beneficiation; preparation concentration	Physical or chemical separation of constituents of interest from a larger mass of material; methods employed to prepare a final marketable product from material as mined. Examples include screening, flotation, magnetic separation, leaching, washing and roasting
Mineral reserve	Ore reserve	A deposit that has been classified as a reserve. "Mineral" is the preferred term in the reporting standard of the Authority, but "ore" is in common use and generally acceptable. Other terms can be used to clarify the meaning, for instance "seabed reserves"
Mineralization	Type of deposit; style of mineralization	Any single mineral or combination of minerals occurring in a mass, or deposit of economic interest. The term is intended to cover all forms in which mineralization might occur, whether by type of deposit, mode of occurrence, genesis or composition
Mining	Seabed harvesting	All activities related to the extraction of metals and minerals from the earth, whether on the surface, underground or on the seabed

Generic term	*Synonym or similar term*	*Definition*
Pre-feasibility study	Preliminary feasibility study	A comprehensive study of the viability of a mineral project that: (a) has advanced to a stage where the mining method has been established and where an effective method of mineral processing has been determined; and (b) includes a financial analysis based on reasonable assumptions of technical, engineering, legal, operating and economic factors and the evaluation of other relevant factors sufficient for a suitably qualified and experienced qualified person to determine, within reason, whether all or part of the mineral resource may be classified as a mineral reserve
Recovery	Yield	The percentage of material of initial interest that is extracted during mining or processing; a measure of mining or processing efficiency
Tonnage	Quantity; volume; abundance	An expression of the amount of material of interest irrespective of the units of measurement (which should be stated when figures are reported)